REMARKS

In this communication, Applicants have amended Claims 1 and 19, and canceled Claims 3, 4 and 6. No new matter is introduced. Claims 1, 2, 5, 7-23 are pending. Allowance of all pending claims are respectfully requested.

Rejections under 35 USC 112

Claim 3 stands rejected under 35 U.S.C. §112, first paragraph, for reasons stated on page 2 of the Office Action. Specifically, the Examiner alleges that the specification fails to teach that the oxide forming step is performed at a pressure of about 1.5 atm or less. Applicants respectfully traverse the rejection.

Claim 3 is an original claim. There is a strong presumption that an adequate written description of the claimed invention is present when the application is filed. In re Wertheim, 541 F.2d 257, 263, 191 USPQ 90, 97 (CCPA 1976). The specification discloses that oxidation and nitridation can be conducted at low pressures in the CVD furnace (page 8, lines 2-3), that the nitridation process can be conducted at pressures of 1.5 atm or less (page 9, lines 17-18), and that the oxide forming and/or nitridation steps are performed at a pressure of about 1 atm or less in a preferred embodiment (page 5, lines 9-10). Considering the fact that Claim 3 itself is part of the specification, one skilled in the art would have no problem recognizing that oxidation at a pressure of about 1.5 atm or less is part of the invention. Accordingly, Applicants respectfully submit that Claim 3 is properly supported by the specification. Withdrawal of the 35 U.S.C. §112 rejection is respectfully requested. Applicants further note that Claim 3 has been canceled and the limitations of Claim 3 have been incorporated into the amended Claim 1.

Rejections under 35 U.S.C. § 102

Claim 1 stands rejected under 35 U.S.C. § 102(e) as being anticipated by U.S. Patent No. 6,294,819 to Sun, and by U.S. Patent No. 5,464,792 to Tseng et al for reasons stated on page 3 of the Office Action. Applicants respectfully traverse the rejection.

For anticipation under 35 U.S.C. §102, the reference "must teach every aspect of the claimed invention either explicitly or impliedly. Any feature not directly taught must be inherently present." (MPEP §706.02, distinction between 35 U.S.C. §102 and 103, page 700-21). "A claim is anticipated only if each and every element as set forth in the claim is found, either expressly or inherently described, in a single prior art reference." Verdegaal Bros. v. Union Oil Co. of California, 814 F.2d 628, 631 2 USPQ2d 1051, 1053 (Fed. Cir. 1987).

Independent Claim 1, as amended, is directed to a method of forming a gate oxide layer on a semiconductor substrate. The method comprises the steps of: forming a gate oxide layer on the substrate by thermal oxidation of the substrate in a chemical vapor deposition furnace at a pressure of about 1.5 atm or less and at a temperature of about 800°C or less; introducing nitric oxide (NO) gas into the chemical vapor deposition furnace; and nitriding the oxide layer in the presence of the nitric oxide gas at a pressure of about 1.5 atm or less and at a temperature of about 800°C or less.

Sun generally describes a method of fabricating a CVD Ta_2O_5/Oxynitride stacked gate insulator with TiN gate electrode for subquarter micron metal-oxide-semiconductor-field-effect transistors (MOSFETs). Sun describes two methods of forming a gate oxide-nitride: (1) a one-step process of direct nitridation of silicon in a rapid thermal processing (RTP) chamber, where oxidation and nitridation occur simultaneously, and (2) a two-step process of forming a gate oxide via thermal oxidation and then nitriding the gate oxide with N_2O or NO. Sun does not disclose or suggest forming the gate oxide layer by thermal oxidation of the substrate **at a**

pressure of about 1.5 atm or less, nor does Sun disclose or teach nitriding the oxide layer in the presence of the nitric oxide gas **at a pressure of about 1.5 atm or less**. For this reason alone, Claim 1 is not anticipated by Sun.

In addition, applicants respectfully submit that Sun does not disclose or teach performing the thermal oxidation and nitridation steps **in a CVD furnace**. The Examiner alleges that Sun teaches forming an oxide layer via thermal oxidation on a substrate by oxidizing the substrate in a CVD furnace because the Ta_2O_5 layer is deposited in a CVD furnace. Applicants respectfully disagree. The Ta_2O_5 layer is deposited in a CVD furnace **after the formation of the gate oxide-nitride**. Nowhere does Sun disclose or suggest forming an oxide layer via thermal oxidation in a CVD furnace. In fact, Sun specifically discloses that, in the one-step method, the oxidation/nitridation is performed in an RTP chamber prior to the deposition of the Ta_2O_5 layer (col. 4, line 46). With respect to the two-step method, Sun is silent about where the oxidation step is performed. However, Sun provides no motivation or suggestion to use a CVD furnace for this step. The nitriding step in the two-step method is accomplished either by rapid thermal nitridation or **in a furnace** at a temperature between 800 to 1000°C (col. 5, lines 12-14). Since CVD furnace are typically not designed for rapid temperature changes or to operate at temperatures exceeding 800°C (see attached 1.132 Declaration from Mr. Ramkumar), it is unlikely that the furnace mentioned above is a CVD furnace.

Tseng generally describes processes for incorporating nitrogen at an interface of a dieelectric layer within a semiconductor device. Tseng does not disclose or suggest forming the gate oxide layer by thermal oxidation of the substrate **at a pressure of about 1.5 atm or less**, nor does Tseng disclose or teach nitriding the oxide layer in the presence of the nitric oxide gas **at a pressure of about 1.5 atm or less**. For this reason alone, Claim 1 is not anticipated by Tseng.

Furthermore, Tseng fails to teach or suggest performing the thermal oxidation and

nitridation steps **in a CVD furnace**. Tseng discloses that "... to form layer 14 as an oxynitride layer, one of several known thermal **or** CVD processes may be used" (col. 3, lines 13-14). The usage of the alternative conjunction "or" suggests that either a thermal process or a CVD process is used for the formation of the oxynitride layer. The Examiner cited the notion in Tseng that "layer 14 can be a stacked CVD/thermal stacked gate oxide" as a teaching for forming the oxide layer 14 via thermal oxidation on a substrate by oxidizing the substrate in a CVD furnace. Applicants respectfully submit that, in view of the specification of Tseng, it would be clear to one skilled in the art that the CVD part of the stacked gate oxide is "deposited" in a CVD furnace and the thermal part of the stacked gate oxide is grown in a conventional furnace. Tseng has never mentioned or suggested forming the oxide layer 14 via thermal oxidation on a substrate in a CVD furnace.

With respect to the nitriding process, Tseng discloses that "Nitric oxide (NO) may be used to form an oxynitirde layer in place of N_2O in either a conventional furnace or rapid thermal processor..." (col. 3, lines 21-23). It thus teaches away from using a CVD furnace for the nitriding process.

Taken together, Applicants respectfully submit that neither Sun nor Tseng teach or suggest every aspect of independent Claim 1. Accordingly, Claim 1 is not anticipated by Sun or Tseng. Withdrawal of the 35 U.S.C. §102(b) rejection is respectfully requested.

Rejections under 35 USC 103

Claims 1, 3-5, 7-10, 13-14 and 18-23 stand rejected under 35 U.S.C. §103(a) as being unpatentable over U.S. Patent No. 6,479,349 to Oya et al., in view of U.S. 2002/0039844 to Lee and the publication by Wolf et al, for reasons stated on pages 4-8 of the Office Action. Applicants respectfully traverse the rejection.

To establish a *prima facie* case of obviousness of a claimed invention, all the claim limitations must be taught or suggested by the prior art. In re Royka, 490 F.2d 981, 180 USPQ 580 (CCPA 1974). "All words in a claim must be considered in judging the patenability of that claim against the prior art." In re Wilson, 424 F.2d 1382, 1385, 165 USPQ 494, 496 (CCPA 1970).

With respect to independent Claims 1 and 19, Applicants respectfully submit that Oya does not teach or suggest forming an oxide layer on a substrate by thermal oxidization **in a CVD furnace**. Oya describes forming the first oxide film 12 by thermal oxidation (col. 4, line 67) but is silent about where the oxidation process takes place. Oya does mention that the second silicon oxide film 15 is formed in a CVD furnace. However, the second silicon oxide film 15 is formed by LPCVD but not by thermal oxidation (col. 6, lines 54-65).

Moreover, Oya does not teach or suggest nitriding the oxide layer **with NO** in a CVD furnace. The first oxide film 12 is not nitridized. Nitridation of the second silicon oxide film 15 is performed either in a diffusing furnace at about 900-1000°C (col. 6, line 67 and col. 8, line 45) with NO, NH_3 or N_2O (col. 7, line 29), or in a LPCVD furnace with N_2O.

Finally, Oya does not teach or suggest performing thermal oxidization at a pressure of 1.5 atm or less, and performing nitridation at a pressure of 1.5 atm or less. Accordingly, Oya does not teach or suggest every limitation of Claims 1 and 19.

Lee and Wolf do not cure the deficiency in Oya. Lee generally describes nitriding a thermally grown silicon dioxide layer with NO (paragraphs 0044 and 0053). Wolf describes that thermally grown silicon oxide layer has a higher quality SiO_2/Si interface. Lee and Wolf do not disclose performing the thermal oxidation and nitridation processes in a CVD furnace, nor do they teach or suggest the pressure and temperature of the thermal oxidation and nitriding process, as recited in Claim 1 of the instant invention.

The Examiner notes that the arguments of counsel cannot take the place of evidence in the record with regard to the difference between CVD oxidation and thermal oxidation. Applicants have included in this communication, a 1.132 Declaration from Mr. Ramkumar to address this issue.

The Examiner alleges that the specification contains no disclosure of either the critical nature of the claimed process (i.e., oxide layer growth via thermal oxidation) or any unexpected results arising therefrom. Applicants respectfully submit that the specification discloses thermal oxidation as a preferred embodiment (page 9, lines 9-10), which indicates the critical nature of the claimed process.

The Examiner also indicates that the preamble limitation of "a gate oxide layer" has not been given patentable weight. Applicants respectfully submit that the limitation of a gate oxide layer has been incorporated into the body of Claims 1 and 19.

The Examiner asserts that it would have been obvious to one having ordinary skill in the art at the time the invention was made to form the oxide layer at the pressure of 1.5 atm or less. However, beyond mere conclusory statements, no prior art reference is cited to support Examiner's position. The mere allegation that the differences between the claimed subject matter and the prior art are obvious does not create a presumption of unpatentability which forces an applicant to prove conclusively that the Patent Office is wrong. In re Soli, 317 F.2d 941 (CCPA 1962). The ultimate legal conclusion of obviousness must be based on facts or records and subjective opinions are of little weight against contrary evidence. In re Wagner et al. 371 F.2d 877 (CCPA 1967). Therefore, the Examiner has not met the burden to establish a prima facie evidence.

Taken together, Applicants respectfully submit that the cited references, individually or in combination, fail to teach or suggest every limitation of the amended Claims 1 and 19. Accordingly, independent Claims 1 and 19 are patentable over Oya, Lee and Wolf.

If an independent claim is nonobvious under 35 U.S.C. §103, then any claim depending thereform is nonobvious. In re Fine, 837 F.2d 1071, 5 USPQ2d 1596 (Fed Cir. 1988). Accordingly, dependent Claims 5, 7-10, 13-14, and 20-23 are patentable because they depend from Claim 1 or 19, and define additional patentable subject matter. Withdrawal of the 35 U.S.C. §103 rejection to Claims 1, 5, 7-10, 13-14, and 19-23 is respectfully requested. Claims 3 and 4 has been canceled. Rejection to these claims are now moot.

Claims 2 and 6 stand rejected under 35 U.S.C. §103(a) as being unpatentable over Oya in view of Lee in view of Wolf in view of Sun, for reasons stated on page 8 of the Office Action. Applicants respectfully traverse the rejection.

As discussed above, none of the cited references teaches or suggests performing thermal oxidation in a CVD furnace at a pressure of 1 atm or less. Moreover, none of the cited references teaches or suggest performing nitridation with NO at a pressure of 1.5 atm or less. Accordingly, the cited references, alone or in combination, do not render Claim 2 obvious. Withdrawal of the 35 U.S.C. §103 rejection to Claim 2 is respectfully requested. Rejection to Claim 6 has been rendered moot by the cancellation of Claim 6.

Claims 11, 12 and 23 stand rejected under 35 U.S.C §103(a) as being unpatentable over Oya in view of Applicants' own admitted prior art for reasons stated on page 9 of the Office Action. Applicants respectfully traverse the rejection.

As discussed above, independent Claims 1 and 19 are patentable over Oya because Oya does not disclose or teach performing thermal oxidation and nitridation in a CVD furnace at a pressure of 1.5 atm or less. Claims 11 and 12 depend from Claim 1, and Claim 23 depends from Claim 19. Accordingly, dependent Claims 11, 12 and 23 are patentable over Oya. The prior art described on pages 1-2 of the specification relates to boron doping of polysilicon gate electrodes but does not teach or suggest performing thermal oxidation in a CVD furnace at a pressure of 1.5 atm or less. Accordingly, the cited prior art does not cure the deficiency of Oya and Claims 11,

12 and 23 are patentable over Oya and the disclosure on pages 1-2 of the specification. Withdrawal of the 35 U.S.C §103 rejection to Claims 11, 12 and 23 is respectfully requested.

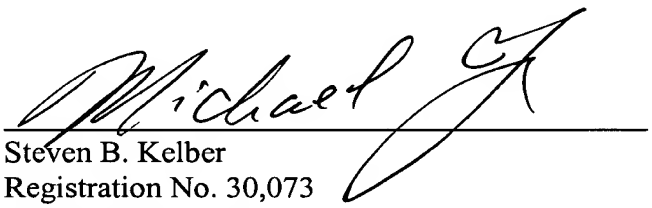
Claim 15 stands rejected under 35 USC 103(a) as being unpatentable over Oya in view of U.S. Patent No. 6,323,094 to Wu for reasons stated on pages 9-10 of the Office Action. Claim 16 stands rejected under 35 U.S.C. §103(a) as being unpatentable over Oya in view of U.S. Patent No. 6,436,818 to Hu et al., for reasons stated on page 10 of the Office Action. Claim 17 stands rejected under 35 U.S.C. §103(a) as being unpatentable over Oya in view of Microchip Fabrication to Van Zant for reasons stated on page 11 of the Office Action. Applicants respectfully traverse the rejections.

As discussed above, independent Claim 1 is patentable over Oya because Oya does not disclose or teach performing thermal oxidation and nitridation in a CVD furnace at a pressure of 1.5 atm or less. Claims 15, 16 and 17 depend from Claim 1. Accordingly, dependent Claims 15 16 and 17 are patentable over Oya. Wu generally describes a method of fabricating a complementary metal oxide semiconductor field effect transistor. Hu generally describes a method of fabricating a complementary metal oxide semiconductor field effect transistor. Van Zant generally describes oxidation methods including dry oxidation. None of these references teaches or suggests performing thermal oxidation in a CVD furnace at a pressure of 1.5 atm or less. Accordingly, Applicants respectfully submit that Wu, Hu and Van Zant do not cure the deficiency of Oya and Claims 15, 16 and 17 are patentable. Withdrawal of the 35 U.S.C. §103 rejections to Claims 15, 16 and 17 is respectfully requested.

In view of the foregoing remarks, favorable reconsideration of all pending claims is requested. Applicants respectfully submit that this application is in condition for allowance and requests that a notice of allowance be issued. Should the Examiner believe that anything further is required to expedite the prosecution of this application or further clarify the issues, the Examiner is requested to contact Applicants' representative at the telephone number listed below.

Respectfully submitted,

PIPER RUDNICK LLP



Steven B. Kelber
Registration No. 30,073
Attorney of Record

Michael Ye
Registration No. 47,195

1200 Nineteenth Street, N.W.
Washington, D.C. 20036-2412
Telephone No. (202) 861-3900
Facsimile No. (202) 223-2085